



Ministry
of the
Environment

Water Resources
Map 3128

Hon. Harry C. Parrott, D.D.S., Minister
Graham W.S. Scott, Deputy Minister

Water Resources Branch
Hydrology and Monitoring Section



**Region
of
Peel**

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Ground water probability :
regional municipality of peel /
Hickinbotham, A.
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**Ground Water
Probability**

by

A. Hickinbotham, 1979

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ONTARIO MINISTRY OF THE ENVIRONMENT

WATER RESOURCES BRANCH

MAP 3128

GROUND WATER PROBABILITY

REGIONAL MUNICIPALITY OF PEEL

DESCRIPTIVE NOTES

INTRODUCTION

Ground water is an important source of water supply in the Regional Municipality of Peel. The northern half (Town of Caledon) of the Regional Municipality, especially the municipalities of Bolton, Mono Mills and Caledon East, rely almost exclusively on ground water. As a result of a vast increase in urban development in the last decade in the southern half of the Region, most of the water needed for domestic, commercial and industrial uses is now piped from Lake Ontario and ground water has declined in importance as a source of supply in this area.

This publication is designed to provide insight into ground-water availability and to provide essential information needed for decisions concerning ground water throughout the Region of Peel. This information is indicated in terms of the probable quantities of water that are available, depths at which water is commonly found and water quality at sampled locations. Because of the complexity of ground-water occurrence in the Region, the information is presented on four map sheets:

- Sheet 1: Supplies in Shallow Overburden
- Sheet 2: Supplies in Deep Overburden
- Sheet 3: Supplies in Bedrock
- Sheet 4: Water Quality

Hydrogeologic interpretations have been based on data obtained from water-well records on file with the Ministry of the Environment and from other documented studies of ground-water availability. The appropriate references are listed on each map sheet. The reliability of the interpretations varies throughout the Region and a periodic updating or revision of the present interpretations may be necessary as new hydrogeologic information becomes available.

Evaluation of Prospective Well Sites

By using the maps in this publication and the following step-by-step procedure, prospective well sites can be evaluated in terms of probable yields, the likely depths to the water-bearing zones and the likely quality of water. Subsequently, this information can be used in other considerations such as: possible water treatment requirements, pump type and size, and the type and cost of well construction (a table illustrating the types of well constructions and their applications is appended).

As a first step, the amount of water required from a prospective well should be estimated. Assessment of domestic and livestock requirements is discussed in the appendix. The maps should then be used in the suggested sequence in order to obtain the most economical supplies. Map 3128-1 indicates yields from the shallowest formations and should be consulted first. Progressively deeper and more costly wells will have to be constructed as water is sought from the deeper formations indicated on maps 3128-2 and 3128-5.

Evaluation Procedure

A. To evaluate yields:

1. locate the well site on Map 3128-1 of Sheet 1;
2. note the colour of the map at the well site;
3. refer to the legend and relate the colour to the probable yield;
4. if the probable yield does not meet your water requirements, repeat steps 1 through 3 using Map 3128-2 on Sheet 2. Similarly, if the probable yield determined from Map 3128-2 is insufficient, repeat the same steps using Map 3128-5 on Sheet 3.

B. To evaluate the depths to water-bearing zones:

5. if Map 3128-1 was selected in the above steps, water-bearing zones occur at depths easily reached by shallow bored wells (i.e. within 50 feet of the surface); if Map 3128-2 was selected, locate the well site on Map 3128-3 and note the depth(s) to the water-bearing zone(s); if Map 3128-5 was selected, locate the well site on Map 3128-6 and note the depth(s) to the water-bearing zone(s);
6. the exact depth(s) to water-bearing zone(s) for individual existing wells are shown on maps 3128-1, 3128-3 and 3128-5.

C. To evaluate water quality:

7. to evaluate the likely ground-water quality at a potential well site, note the nearby ground-water sampling points on the yield map that was selected. Chemical analyses of these samples are found in the inorganic chemical analyses tables 1, 2 and 3 on Sheet 4. To interpret the significance of the analyses, refer to the "Water Quality" section in these notes.

Ground-Water Yield

On each of the yield maps, the quantities of water available to single wells are presented as probable yields of less than 2 gpm (gallons per minute), 2 to 10 gpm, 10 to 50 gpm and greater than 50 gpm. Because of variations in the local hydrogeology, the type of well construction, and the reliability of available data, the probable well yields indicated on the maps may not everywhere represent yields available to all wells. However, the indicated yields are thought to be good approximations in most areas. In cases where reliable, long-term yields are sought, it is necessary to undertake detailed hydrogeologic investigations and pumping tests.

In shallow overburden (Map 3128-1), yields of less than 2 gpm are associated with poorly permeable materials such as the clay and till deposits in the southern half of the Region and in the area above the Niagara Escarpment, which runs in a line from approximately Mono Mills south to Terra Cotta. These yields are generally inadequate for domestic supplies unless appropriate storage facilities are part of the water-supply system. Yields of 2 to 10 gpm can be obtained from shallow deposits of sands and gravels interbedded with minor lenses of clay throughout much of the northern half of the Region east of the Escarpment and from shallow sand deposits in the Credit River valley and south of Highway 401. Yields of 10 to 50 gpm and greater than 50 gpm are encountered in sand and gravel deposits in the glacial meltwater channels extending south from Orangeville to just east of Caledon East and in shallow sand and gravel deposits in the Brampton Esker, which extends from north of Heart Lake to south of Highway 7.

Yields from deep overburden (Map 3128-2) vary considerably, reflecting the complex lithology in the Region. Yields of less than 2 gpm are associated with the deep overburden deposits above the Niagara Escarpment and in isolated areas scattered throughout the rest of the Region. Yields of 2 to 10 gpm can be obtained from deep overburden throughout much of the area east of the Escarpment and in deposits west and east of Brampton. Yields of 10 to 50 gpm are associated with sands and gravels in glacial meltwater channels in the western section of the Town of Caledon, underlying the Brampton Esker (northwest of Brampton, parallel to Highway 10), and in isolated areas throughout most of the Region east of the Escarpment. Yields greater than 50 gpm can be obtained from deep sand and gravel deposits southwest and northeast of Brampton and in isolated areas throughout the northern half of the study area.

In bedrock (Map 3128-5), low water-yielding formations extend throughout most of the study area. These are composed mostly of shales, silty limestones and siltstones. High water-yielding formations occur in the northwestern part of the Town of Caledon where the bedrock formations consist mainly of dolomite.

Depths to Water Bearing Zones

Water can be found within 50 feet of the surface in shallow overburden deposits above the Niagara Escarpment and in most of the southern half of the region (Map 3128-1). Depths to water-bearing zones in deep overburden and in bedrock (maps 3128-3 and 3128-6, respectively) indicate the depths at which wells can obtain the yields reported on maps 3128-2 and 3128-5. Water-bearing zones in bedrock commonly occur as fissures within the first 20 feet of the bedrock surface. Deeper zones do occur but are exploited less frequently as they are more costly to reach and generally contain poor quality water.

Overburden Thickness

Overburden thickness (Map 3128-4) in the northern part of the Region (Town of Caledon) increases from less than 50 feet in most of the area above the Escarpment in the west to over 300 feet in the east. In the southern part of the Region, the overburden thickness is generally less than 50 feet, with thicker deposits in the bedrock valleys outlined on map 3128-7.

Bedrock Geology and Topography

Bedrock geology (Map 3128-7) consists mainly of red and blue shale and dolomite with some interbeds of siltstone and limestone. There is an overall rise of the bedrock surface from south to north. Elevations increase from a low of less than 250 feet along the shore of Lake Ontario to a maximum of 1500 feet west of Mono Mills in the northern extremities of the Region.

The Niagara Escarpment, in the northwestern portion of the Region, is a major bedrock topographic feature that trends approximately north-south between Mono Mills and Terra Cotta.

There are several well-defined bedrock valleys situated north and south of Brampton and north of Bolton. In addition, there are two valleys that cut the Escarpment near Belfountain and Alton in the northwestern section of the Town of Caledon.

Water Quality

Ground-water quality in the overburden is generally good, although much of the water is very hard; ground water from bedrock, mostly from shale formations, is often salty. The inorganic chemical quality of ground water throughout the Region may be estimated by referring to the analyses of ground-water samples shown in tables 1, 2 and 3 on Sheet 4. The locations of samples are shown on maps 3128-1, 3128-2, and 3128-5. The samples were taken from selected overburden and bedrock wells and indicate the quality of ground water in the common water-bearing zones in different parts of the Region.

Of the 36 samples taken, 9 were obtained from shallow overburden wells (Table 1), 14 samples were taken from deep overburden wells (Table 2), and 13 samples represent the water quality in the bedrock (Table 3).

In order to obtain water of desirable quality, objectives regarding limits of concentration of certain substances are required. The following table summarizes these objectives from the publication: "Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment, 1978". These criteria are maximum concentrations recommended for drinking water supplies and for agricultural uses. While the criteria should generally be adhered to, slight excesses are usually not harmful. In cases where quality of the water supply is in doubt, local health authorities should be consulted.

WATER-QUALITY PARAMETERS

Substance	Significance	Drinking Water Quality Criteria	Agricultural Water Quality Criteria
Iron	Iron in excessive concentrations will precipitate after exposure to air, which causes turbidity, stains plumbing fixtures, laundry and cooking utensils, and imparts objectionable tastes and colours to foods and drinks.	0.3 mg/l*	not specified
Hardness (Calcium, Magnesium)	Consumes soap before a lather will form. Hard water forms scale in water heaters and pipes. Waters of hardness greater than 180 mg/l are classified as very hard.	not specified	not specified
Sodium Potassium	Large amounts in combination with chloride give a salty taste. Moderate quantities have little effect on the usefulness of water for most purposes. A high sodium content may limit the use of water for irrigation and in some instances for domestic consumptive uses.	not specified	not specified
Sulphate	In large amounts, sulphate can have laxative effects on unaccustomed users and in combination with other ions, gives a bitter taste to water.	250 mg/l	not specified
Chloride	In large amounts and in combination with sodium, chloride gives water a salty taste and increases the corrosiveness of water.	250 mg/l	not specified
Fluoride	In large amounts, fluoride can disfigure teeth by mottling the enamel. However, in more desirable amounts (1.0 mg/l), fluoride has been found to inhibit tooth decay.	2.4 mg/l	2.0 mg/l
Nitrate	Concentration much greater than the natural regional background may suggest pollution. Waters of high nitrate content cause methemoglobinemia (an often fatal infant disease) and therefore should not be used in infant feeding. Nitrate encourages the growth of algae and other organisms that produce undesirable tastes and odours.	10 mg/l	100 mg/l **
Dissolved Solids	High dissolved solids may often suggest that criteria of one or more substances have been exceeded.	500 mg/l	3000 mg/l

* mg/l = milligrams of substance per litre of water

** nitrate + nitrite

Salty Water in Bedrock Wells

A salty taste in ground water can be attributed to chloride concentrations that are generally greater than 250 mg/l, coupled with high concentrations of sodium and potassium.

Approximately 7 percent of the bedrock wells drilled in the Region yield salty water. The majority of these wells are situated in the Town of Caledon (Sheet 4, Map 3128-8) where their occurrence is generally erratic. A salt-free area occurs above the Niagara Escarpment where bedrock wells are predominantly completed in dolomite and limestone formations.

Depths from the bedrock surface to the salty water-bearing zones are highly variable and have no discernible trends in the Region. In an effort to avoid salty-tasting water, adequate supplies should first be sought from overburden aquifers. If this is not possible, the depths to salty water-bearing zones (depicted on Map 3128-8) in wells situated close to a proposed well site will give some indication of the depths at which salty water may be encountered.

APPENDIX

ASSESSING DOMESTIC AND LIVESTOCK WATER REQUIREMENTS

When constructing a water well, all present and anticipated water requirements should be estimated beforehand in order to determine the well yield necessary for an adequate supply of water. A well must be able to supply both the daily and peak-period water requirements of the household. Otherwise, a water storage tank may have to be installed.

To estimate the approximate domestic and livestock daily water requirements, multiply the number of users (people and animals) by the appropriate figure in the table below. If desired, an additional 20 to 30% supply can be added to the total to account for increased demand in the future. While individual residential needs are difficult to estimate, most homes with water-consuming items such as washing machines will average about 100 gallons per day per person.

It is important to take into account the water demand during peak periods of usage in order that the well does not run dry temporarily. This demand can be estimated by counting the number of fixtures and water outlets in the house which will be used at one time and multiplying it by the flow rate for each. Tables showing the flow rate for fixtures can be obtained from water-supply equipment dealers.

Approximate Daily Water Requirements

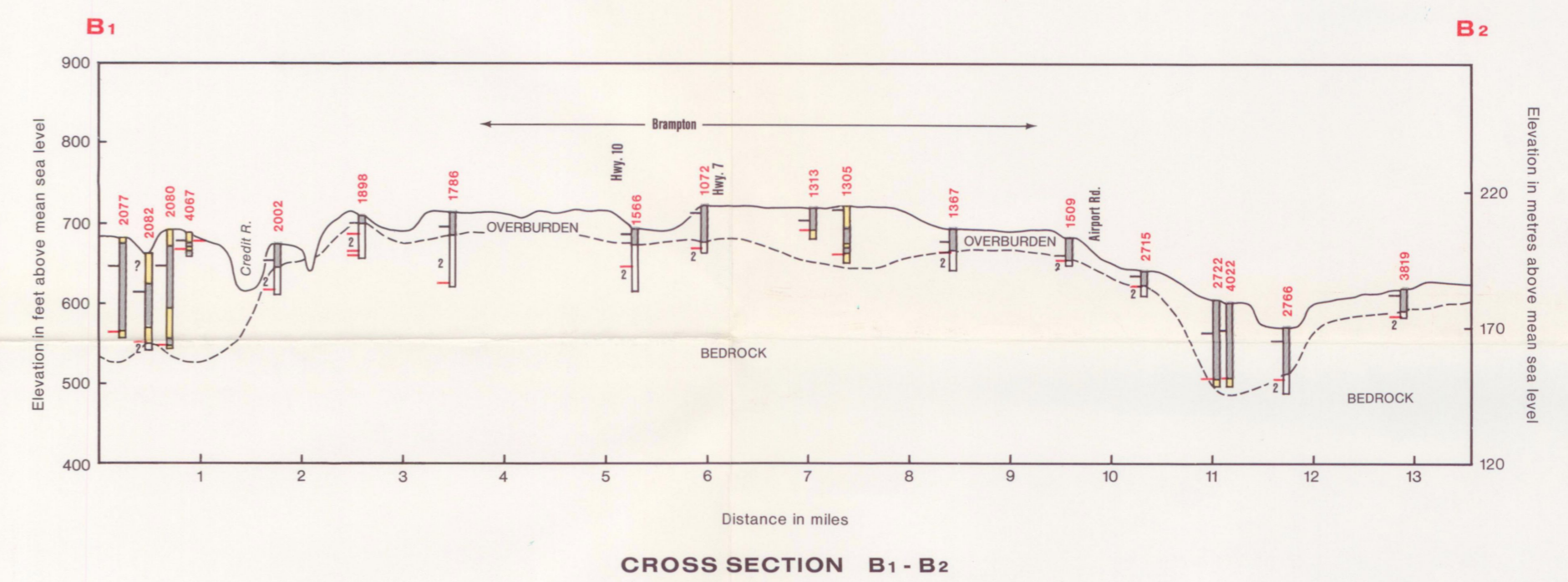
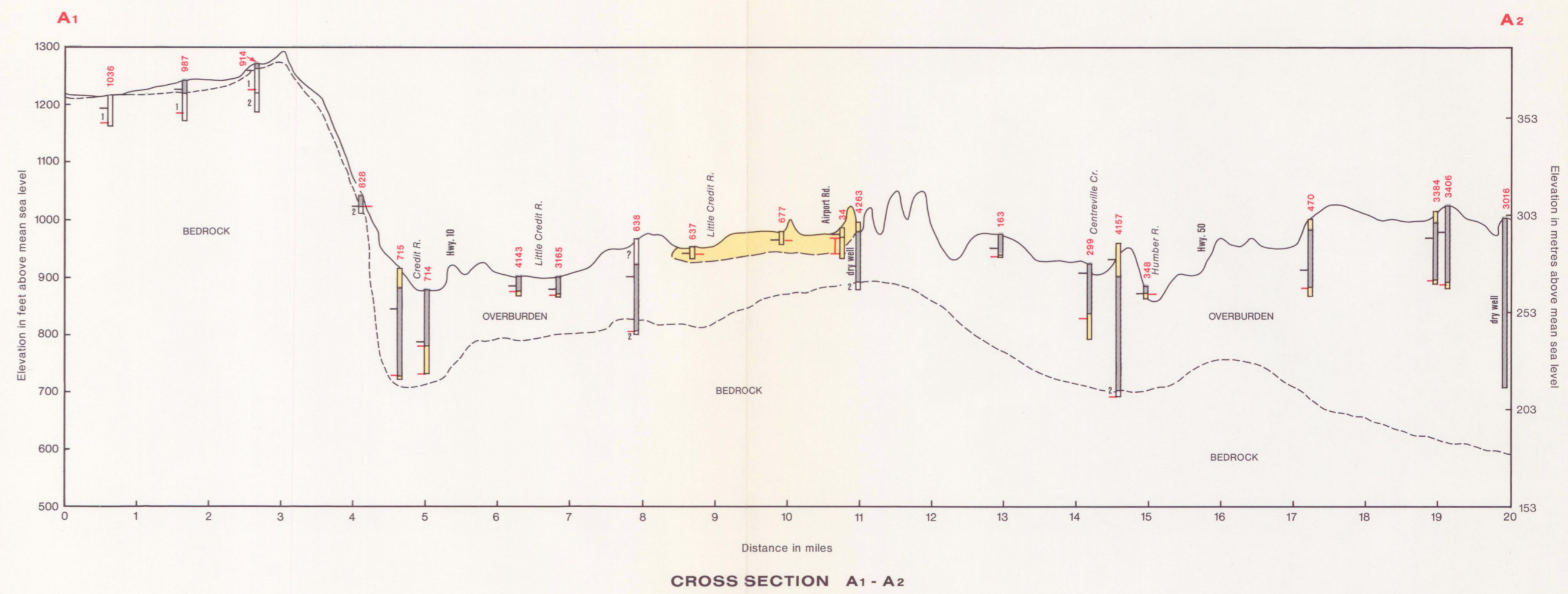
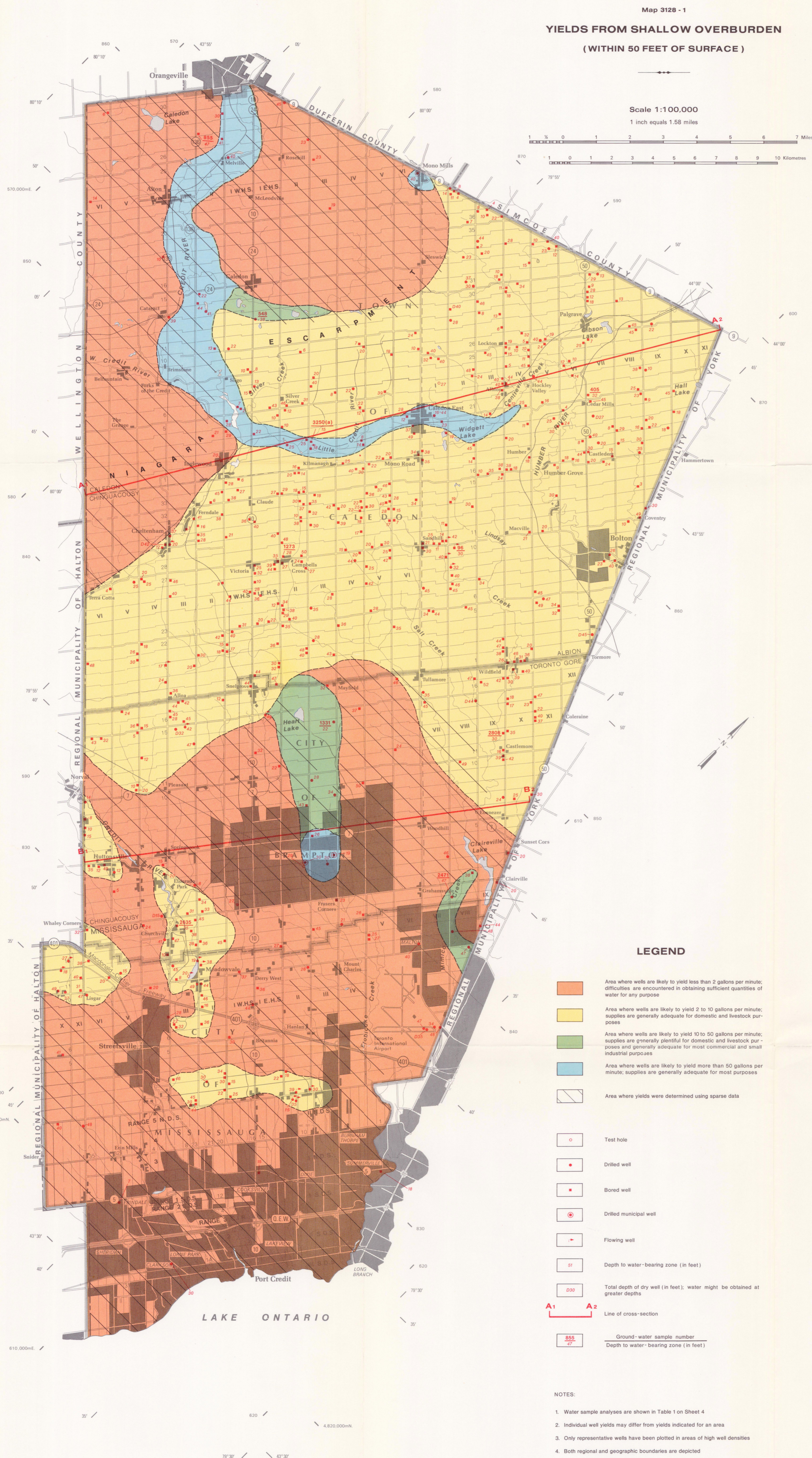
each member of the family (kitchen, laundry, bath).....	50 to 150 gallons per day
each producing milk cow (including washing).....	35 gallons per day
each dry cow.....	15 " " "
each steer, horse.....	12 " " "
each hog.....	4 " " "
each sheep.....	2 " " "
each 100 chickens.....	6 " " "
each 100 turkeys.....	12 " " "

- table modified from F. R. Hore, Farm Water Supply, Ontario Department of Agriculture and Food, Publication 476.

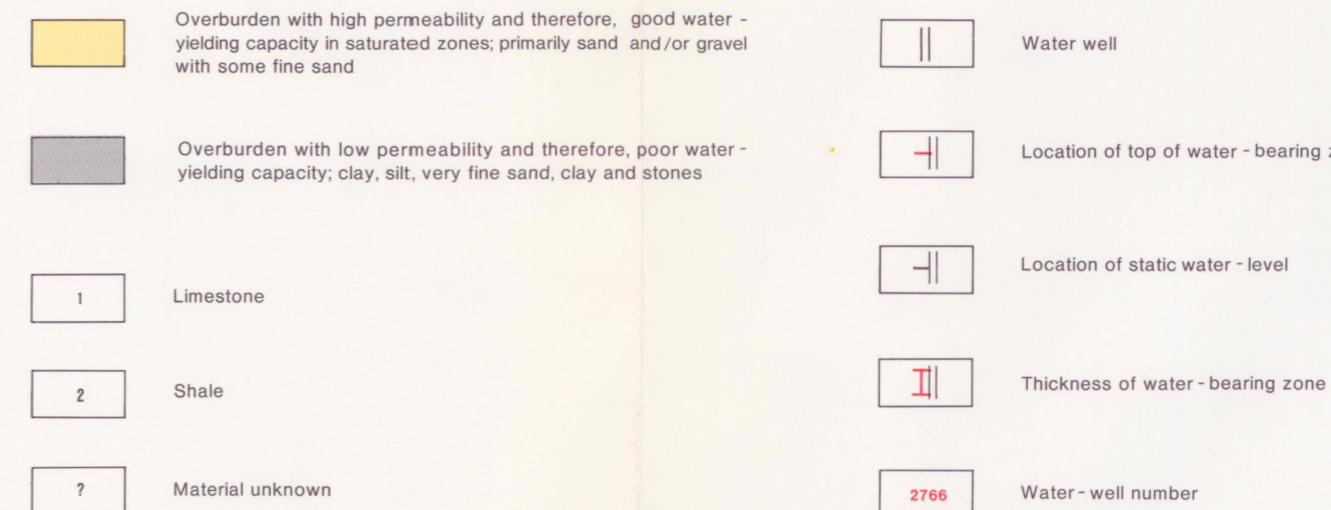
For information on irrigation requirements contact your regional office of the Ontario Ministry of Agriculture and Food.

A COMPARISON OF DIFFERENT WELL TYPES AND THEIR APPLICATION

WELL TYPE	SUITABLE GEOLOGIC MATERIALS	ADVANTAGES	DISADVANTAGES
DUG WELLS	OVERBURDEN both low and high yielding materials (gravel, sand, silt, clay)	1) Does not require special machinery 2) Large diameter provides reservoir storage; augments low yields 3) Can be constructed in areas of limited access	1) Labour intensive to construct 2) Depth is limited because of caving 3) Well failure is common during dry periods because of usually shallow depths
BORED WELLS	OVERBURDEN both low and high-yielding materials (gravel, sand, silt, clay)	1) Efficient method of constructing large-diameter wells 2) Large diameter provides reservoir storage; augments low yields	1) Depth is usually limited because of well-drilling equipment limitations and very hard earth materials
DRILLED WELLS	OVERBURDEN AND BEDROCK moderate to high-yielding materials (sand, gravel, sandstone, limestone)	1) Can reach deeper depths than other techniques 2) Can penetrate bedrock	1) Generally small-diameter wells with little reservoir storage capacity
DRIVEN OR JETTED WELLS (Sand Points)	OVERBURDEN moderate to high-yielding materials (sand and gravel)	1) Simple installation; can be done by hand or machine 2) A number of these wells can be hooked into one water supply	1) Small diameter provides little reservoir storage 2) Depth is limited; depends on tightness of overburden



LEGEND FOR CROSS SECTIONS



Horizontal scale 1 : 100,000
Vertical scale 1 inch = 200 feet

NOTES

- Wells shown above or below ground level indicate projection onto the line of cross section.
- Locations of cross sections are shown on Map 3128 - 1.

Well log information derived from water-well records on file with the Ontario Ministry of the Environment as of March 1977.

SOURCES OF INFORMATION

Chapman, L.J. and Putnam, D.F., 1972. Physiography of the south-central portion of Ontario. Ont. Dept. Mines and Northern Affairs, Map 2225.

Cowan, W.R., 1976. Quaternary geology of the Orangeville area, southern Ontario. Ont. Div. Mines, Geol. Rept. 141, Maps 2326, 2327.

Hewitt, D.F., 1969. Industrial mineral resources of the Brampton area. Ont. Dept. Mines, Ind. Min. Rept. 23, Map 2275.

Ontario Water Resources Commission, 1963. Report on water resources survey, County of Peel; Div. Water Resources.

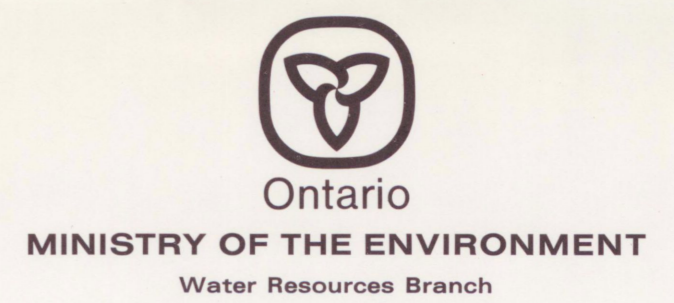
Regional Municipality of Peel, 1975. Physical survey, towards a regional official plan; Policy Div., Planning Dept.

White, O.L., 1975. Quaternary geology of the Bolton area, southern Ontario. Ont. Div. Mines, Geol. Rept. 117, Map 2275.

Hydrogeologic information derived from water-well records on file with the Ontario Ministry of the Environment as of March 1977.

Base map derived from the Regional Map of the Ontario Ministry of Treasury, Economics and Intergovernmental Affairs.

Map compilation and interpretation by A. Hickinbotham and D. Walsley.
Cartography by B. Fischer.



REGIONAL MUNICIPALITY OF PEEL

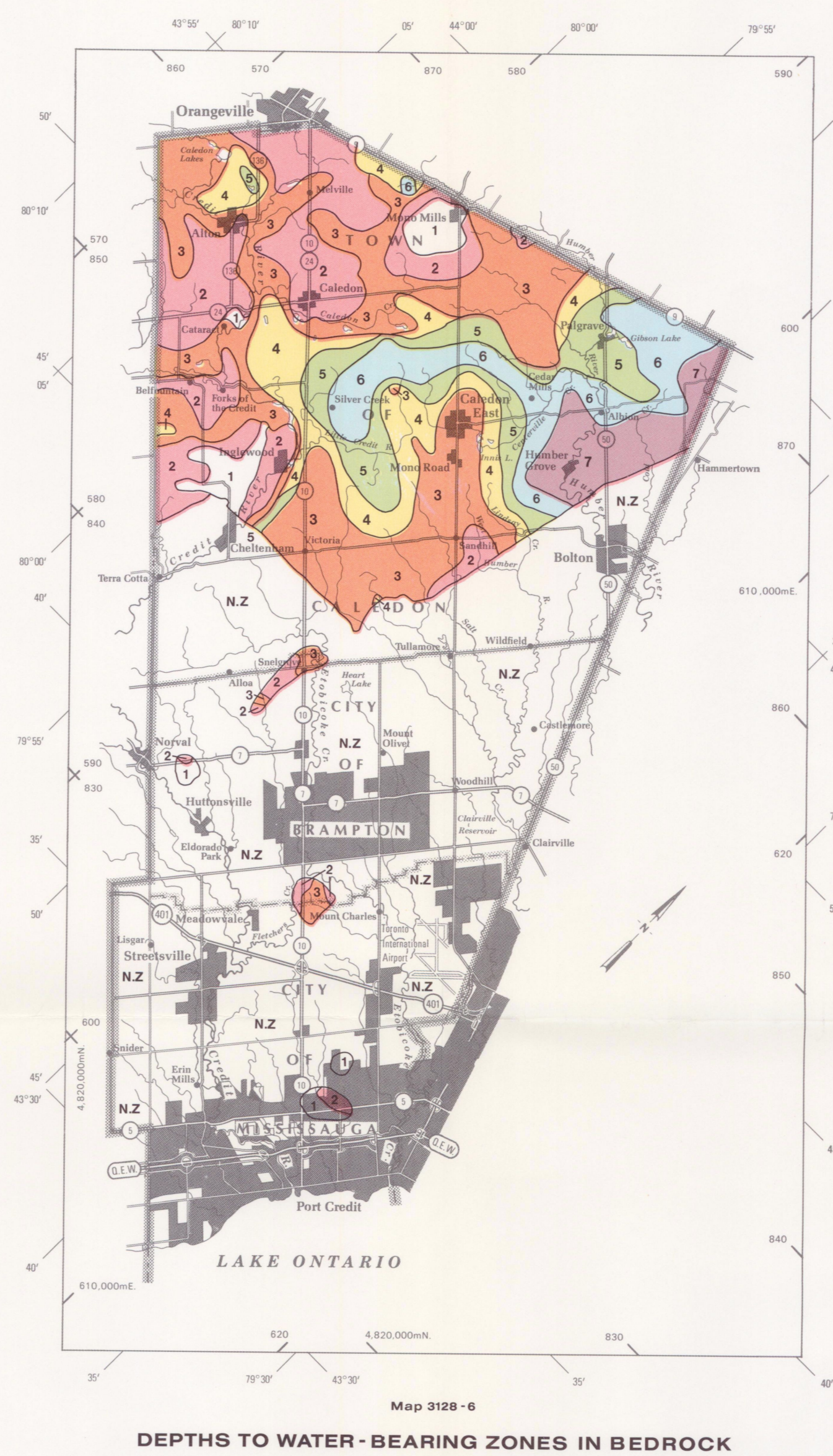
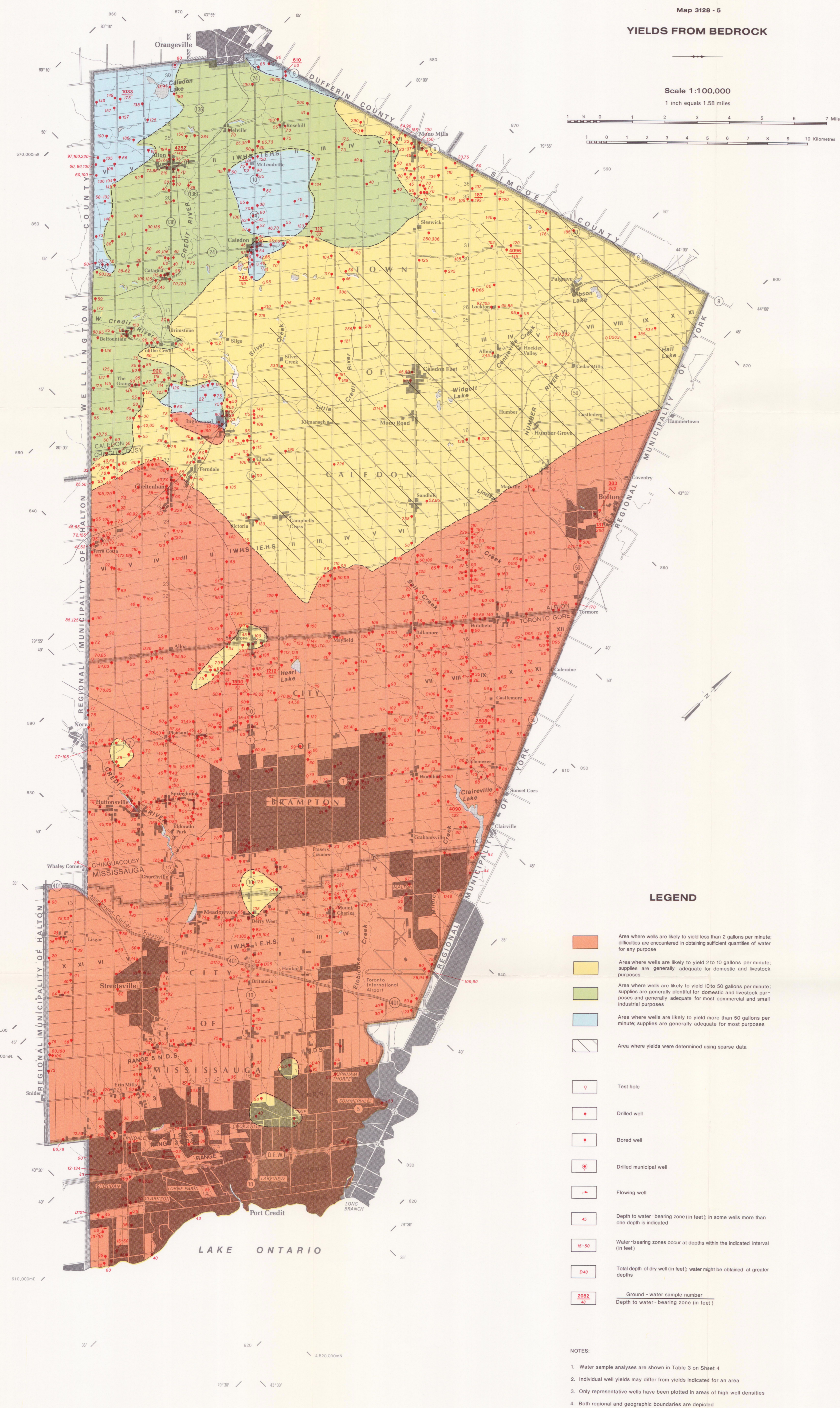
Map 3128

GROUND - WATER PROBABILITY

SHEET 1

WATER SUPPLIES IN SHALLOW OVERBURDEN

(WITHIN 50 FEET OF SURFACE)



Ontario
MINISTRY OF THE ENVIRONMENT
Water Resources Branch

REGIONAL MUNICIPALITY OF PEEL

Map 3128

GROUND - WATER PROBABILITY

SHEET 3
WATER SUPPLIES IN BEDROCK

INORGANIC CHEMICAL ANALYSES OF GROUND - WATER SAMPLES

Table 1. Inorganic Chemical Analyses - Overburden Wells within 50 Feet of Surface
(sample locations shown on Map 3128 - 1)

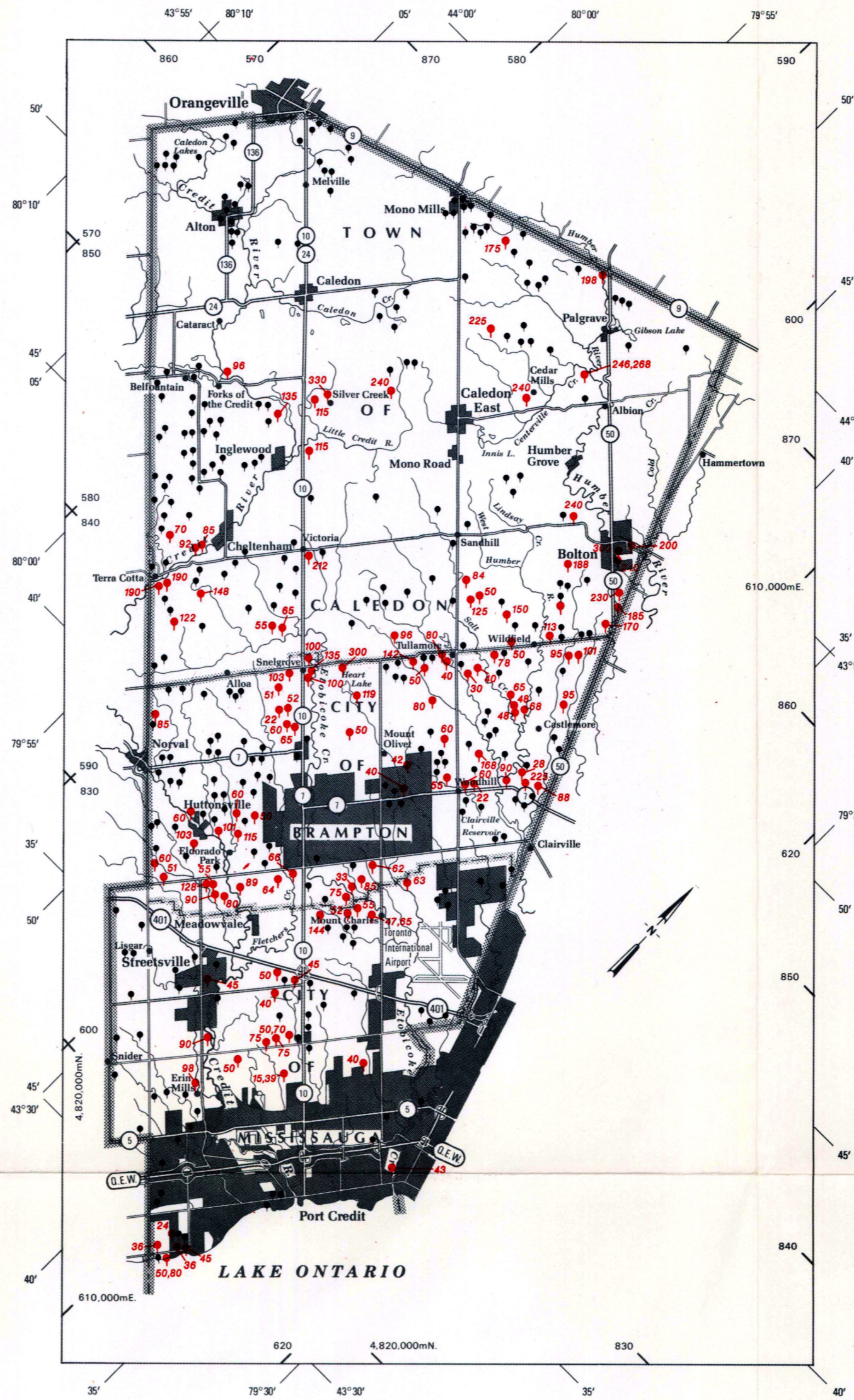
Sample or Well No.	Sampling Date	pH in Lab	Constituents in milligrams per litre (mg/l)									Total Alkalinity as mg/l (CaCO ₃)	Total hardness as mg/l (CaCO ₃)	Specific Conductance in Lab (µmho/cm ² at 25° C)	Temp. in Field (°C)
			Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (N)				
96	24/12/75	7.4	.75	85	18	3	1.5	348	12	1	<0.2	269	286	510	10
405	23/12/75	7.3	8.1	176	36	28	2.3	719	100	91	23	356	590	1270	10
548	29/ 9/77	7.9	0.10	50	11	6	1.4	134	24	17	1	134	172	355	-
855	23/12/75	7.5	0.35	80	17	40	<0.2	378	31	70	<0.2	215	269	680	9
1273	23/12/75	7.2	0.05	168	37	110	1.7	699	74	255	16	347	573	1540	9
1331	30/ 9/77	7.8	0.05	51	37	27	4.2	227	35	40	4.2	227	280	620	-
2471	30/ 9/77	7.9	0.95	80	50	107	7.7	215	130	204	7.4	215	404	1275	-
2635	29/ 9/77	7.9	0.60	34	22	39	1.6	215	27	19	<0.1	215	175	480	-
3250a	23/12/75	7.6	0.05	107	11	15	1.7	380	35	31	6	232	312	635	12

Table 2. Inorganic Chemical Analyses - Overburden Wells between 50 Feet from Surface and Bedrock
(sample locations shown on Map 3128 - 2)

Sample or Well No.	Sampling Date	pH in Lab	Constituents in milligrams per litre (mg/l)									Total Alkalinity as mg/l (CaCO ₃)	Total hardness as mg/l (CaCO ₃)	Specific Conductance in Lab (µmho/cm ² at 25° C)	Temp. in Field (°C)
			Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (N)				
15	30/ 9/77	7.7	0.25	44	21	155	5.2	144	79	214	2.6	144	195	1100	-
64 d	24/12/75	7.8	1.2	98	30	190	7.4	449	440	174	0.6	59	368	1550	10
304	30/ 9/77	7.7	0.90	60	15	5	1.4	185	33	<1	<0.1	185	211	400	-
328	30/ 9/77	7.6	1.1	72	21	6	1.4	256	20	2	<0.1	256	266	495	-
598	23/12/75	7.5	0.05	96	20	3	1	394	39	9	1.6	264	323	580	7
848 b	23/12/75	7.4	0.25	77	18	6	1.4	322	25	17	2	217	264	500	8
1328	23/12/75	7.5	<0.02	78	22	5	1.6	341	8	6	<0.2	280	285	520	11
1354	23/12/75	7.7	0.05	59	38	18	2.9	373	30	12	0.5	297	306	605	9
2311	29/ 9/77	7.2	1.7	196	16	50	1.1	302	49	222	1.9	302	554	1290	-
2558	29/ 9/77	7.5	0.1	94	37	14	3.4	364	40	11	0.6	364	388	710	-
2637	29/ 9/77	7.7	0.25	56	38	22	3.3	295	16	24	<0.1	295	295	600	-
2702	24/12/75	7.5	2	85	50	74	5.9	511	22	173	<0.2	316	419	1100	11
3408	30/ 9/77	7.7	0.05	77	14	4	1.2	207	29	13	2.2	207	249	5470	-
3814	24/12/75	7.9	0.5	30	29	31	1.6	239	1	29	<0.2	219	196	480	12

Table 3. Inorganic Chemical Analyses - Bedrock Wells
(sample locations shown on Map 3128 - 3)

Sample or Well No.	Sampling Date	pH in Lab	Constituents in milligrams per litre (mg/l)									Total Alkalinity as mg/l (CaCO ₃)	Total hardness as mg/l (CaCO ₃)	Specific Conductance in Lab (µmho/cm ² at 25° C)	Temp. in Field (°C)
			Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (N)				
187	30/ 9/77	7.7	0.05	112	15	98	6.7	196	114	168	< 0.1	196	340	1090	-
383	30/ 9/77	7.6	0.1	144	28	22	1.8	242	55	159	1.3	242	476	1020	-
610	30/ 9/77	7.4	<0.05	115	24	22	4.7	298	48	29	13.0	298	387	800	-
623	23/12/75	7.6	0.05	83	28	6	0.6	392	26	9	5.8	264	322	590	10
748	29/ 9/77	7.7	0.15	62	36	16	1.8	204	40	69	0.4	204	304	630	-
920	23/12/75	7.4	<0.05	67	22	2	0.8	317	32	2	0.6	226	260	475	10
1023	29/ 9/77	7.7	5.7	54	20	4	1.1	198	26	2	< 0.1	198	217	405	-
1212	29/ 9/77	8.1	0.1	36	5	10	1.5	78	21	22	0.4	78	109	260	-
1590	23/12/75	7.1	0.15	136	64	270	14.0	303	280	445	0.6	249	604	2340	11
2808	24/12/75	7.6	0.05	118	112	47	5.4	922	130	209	9.4	368	756	1550	13
4090	30/ 9/77	8.0	0.15	26	21	55	3.2	153	2	88	0.1	153	151	560	-
4096	23/12/75	7.6	0.55	80	19	97	7.0	336	56	157	< 0.2	215	276	1020	11
4252	29/ 9/77	7.3	0.35	102	25	17	2.9	262	65	42	2.4	262	360	720	-



Map 3128 - 8
SALTY WATER IN BEDROCK WELLS

Scale 1:250,000
1 inch equals approximately 4 miles
5 0 5 10 Miles
5 0 5 10 Kilometres

LEGEND

- Bedrock well with reported salty water; depth to salty water - bearing zone (in feet). In some wells more than one depth to salty water - bearing zones is indicated
- Bedrock well containing fresh water

SOURCES OF INFORMATION

Hydrogeologic information derived from water - well records on file with the Ontario Ministry of the Environment as of March 1977.
Base map derived from the Regional Map of the Ontario Ministry of Treasury, Economics and Intergovernmental Affairs.
Map compilation by D. Walmsley.
Cartography by B. Fischer.

ENGLISH - METRIC (SI) FACTORS

to convert	to	multiply by
feet (ft)	metres (m)	0.305
miles (mi)	kilometres (km)	1.609
gallons per minute (gpm)	litres per second (l/sec)	0.076



MINISTRY OF THE ENVIRONMENT
Water Resources Branch

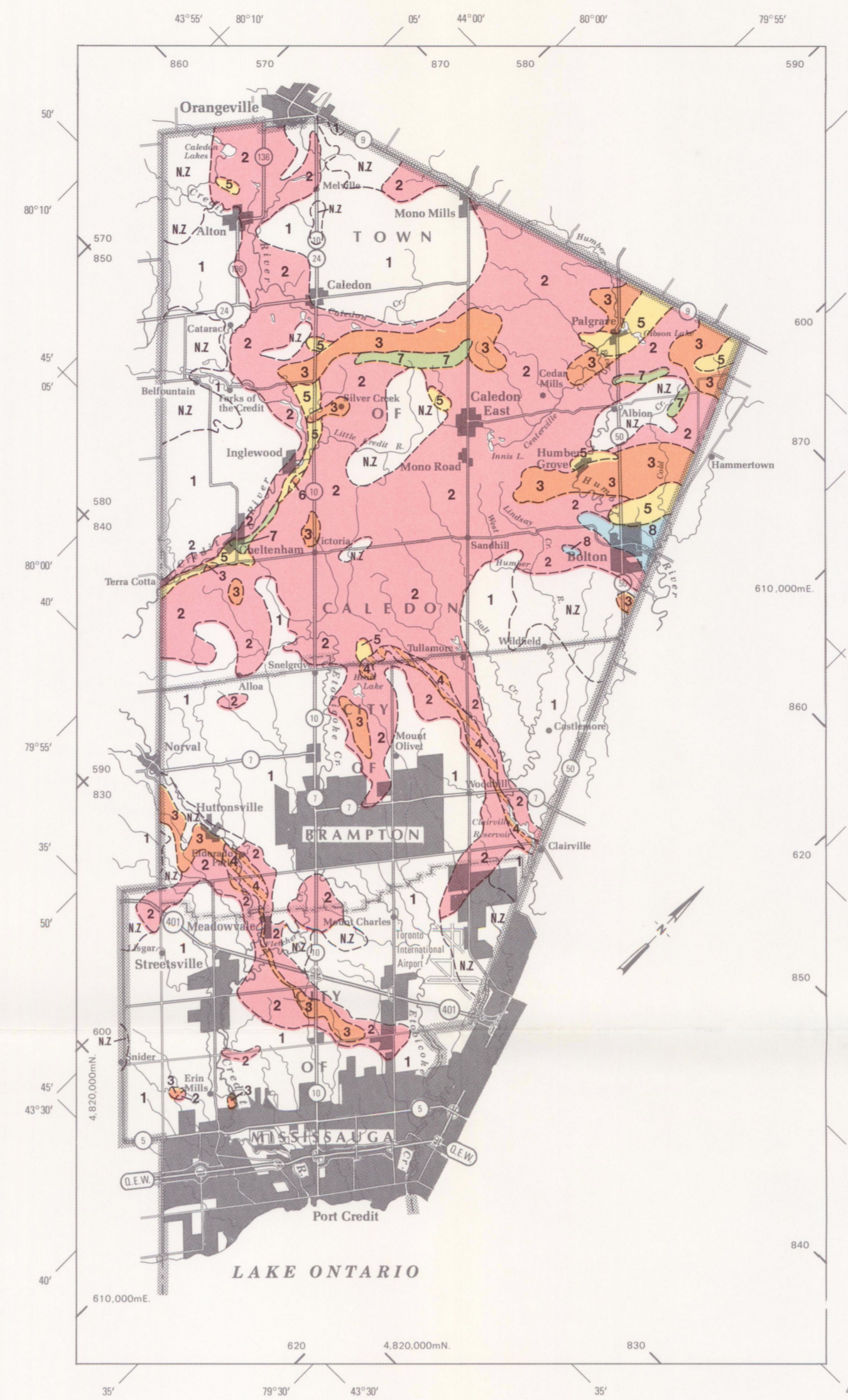
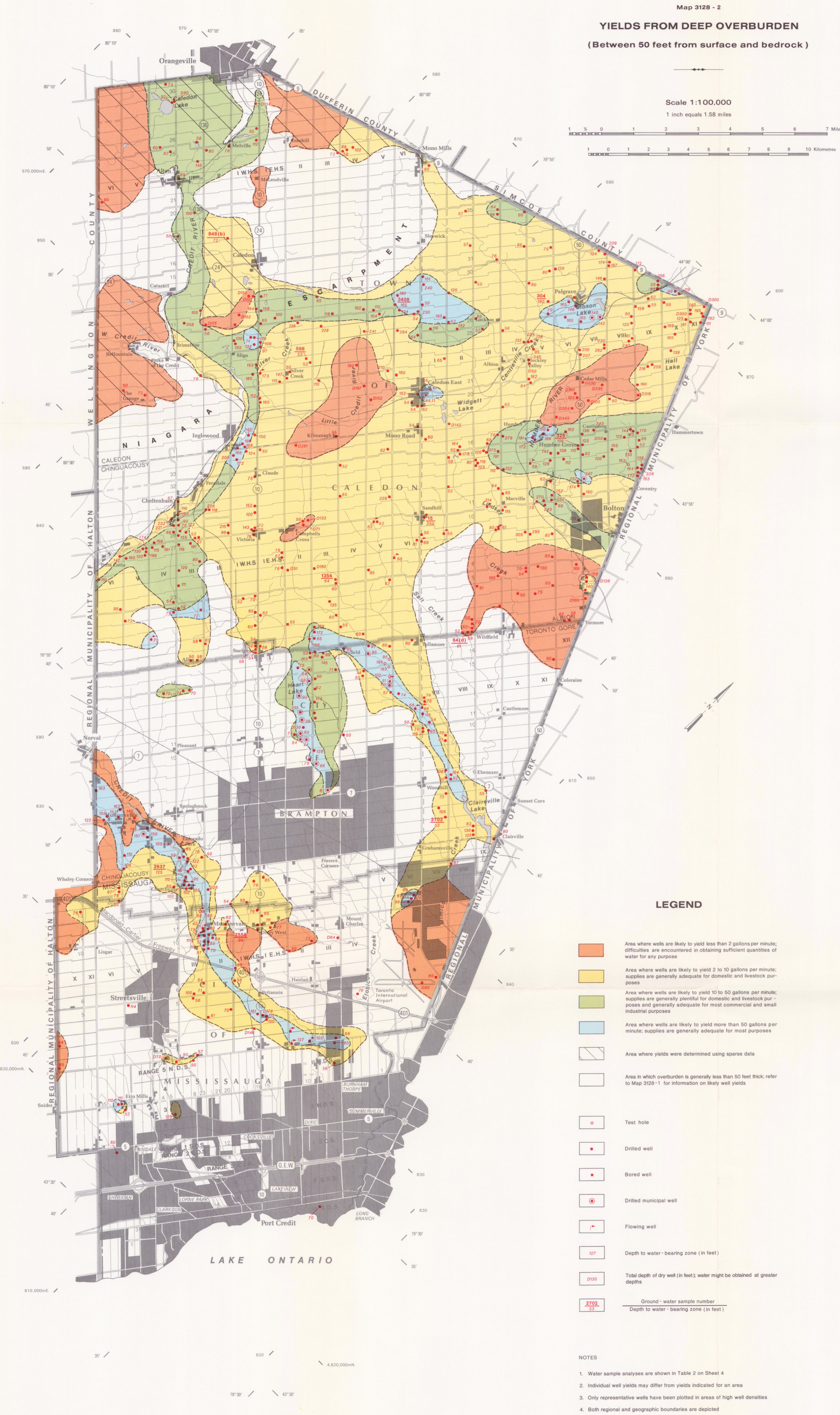
REGIONAL MUNICIPALITY OF PEEL

Map 3128

GROUND - WATER PROBABILITY

SHEET 4

GROUND - WATER QUALITY



SOURCES OF INFORMATION

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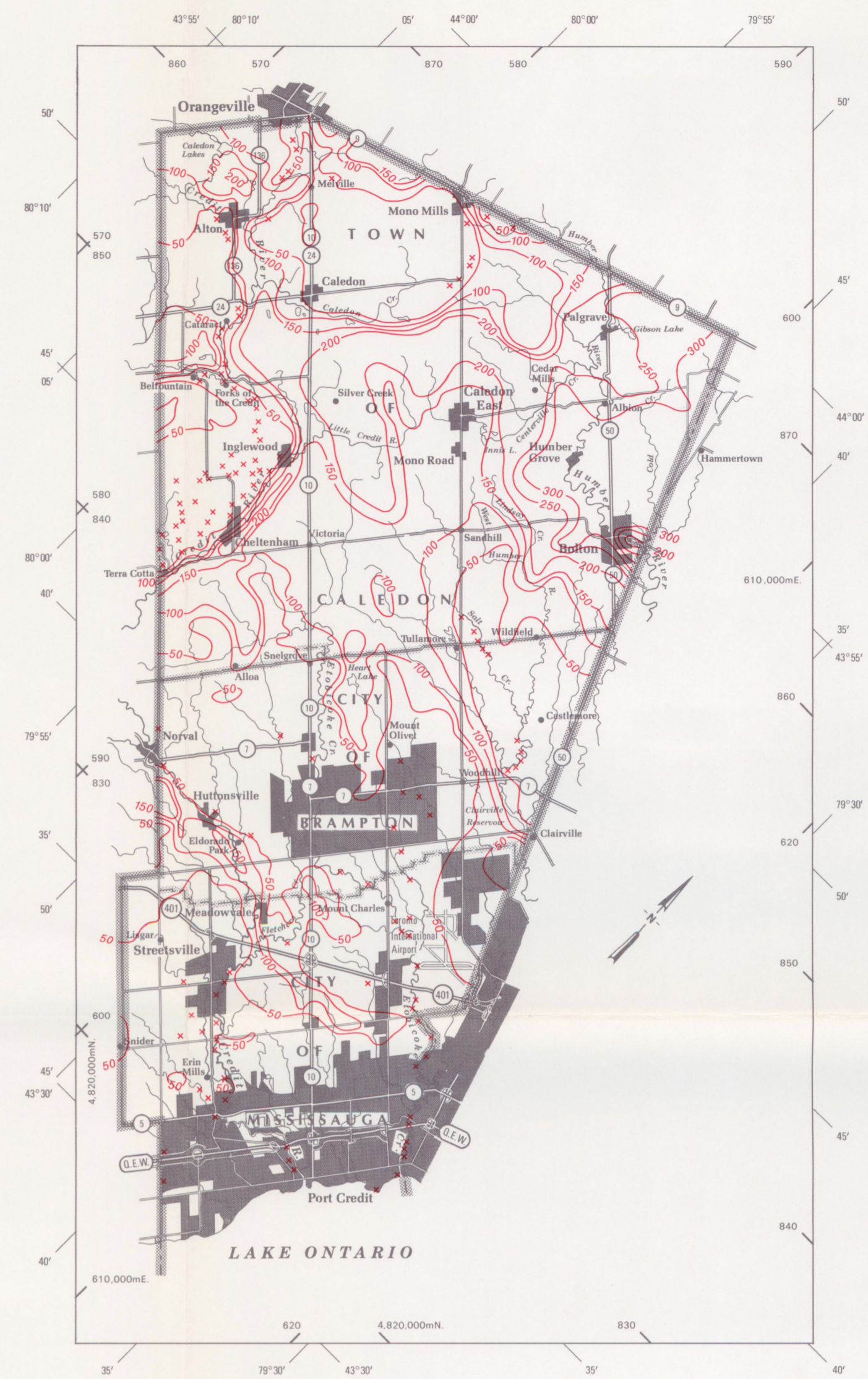
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Base maps derived from the Regional Map of the Ontario Ministry of Treasury, Economics and Intergovernmental Affairs.

Hydrogeologic information derived from water - well records on file with the Ontario Ministry of the Environment as of March 1977.

Map compilation and interpretation by A. Hickinbotham and D. Walmaley.

Cartography by B. Fischer.



REGIONAL MUNICIPALITY OF PEEL

Map 3128

GROUND - WATER PROBABILITY

SHEET 2

WATER SUPPLIES IN DEEP OVERBURDEN
(BETWEEN 50 FEET FROM SURFACE AND BEDROCK)